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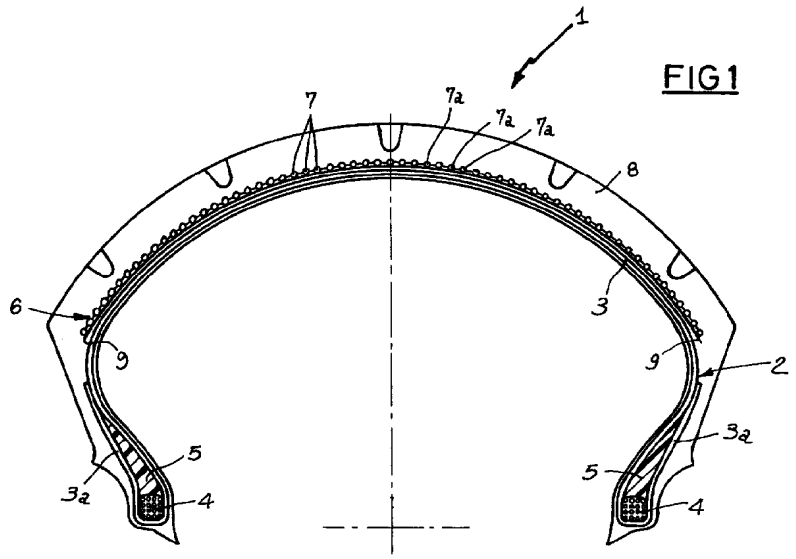
(54) High-transverse-curvature tyre, in particular for motor-vehicle wheels

(57) In a tyre for motor-vehicles, an auxiliary support element (9) is interposed between the carcass ply (3) and belt structure (6), which element is employed during the manufacturing step of the belt structure (6) in order to stably retain, on the sectors of a comb drum (10), the coils (7a) consecutively formed by winding of an inextensible cord (7).
The auxiliary support element (9) is made in the form of an elastomeric sheet containing short aramid fibres in an amount included between 1 and 10 phr, to increase the stretchability of said element without impairing the adhesiveness features of same.
The introduction of the short aramid fibres in the blend enables the thickness of the auxiliary support element (9) to be reduced until values of 0.075 mm.

FIG 1



EP 0 718 122 A1

Description

The present invention relates to a high- transverse-curvature tyre, in particular for motor-vehicle wheels, comprising: a carcass structure consisting of at least one carcass ply having its circumferential end edges turned back around two bead cores; a belt structure extending circumferentially about the carcass ply and having at least one circumferentially inextensible cord wound in a plurality of circumferential coils disposed side by side to define at least one layer of a curvilinear transverse profile; a tread band applied circumferentially to the belt structure; said inextensible cord being wound on an auxiliary support element made in the form of an elastomeric sheet, interposed between the belt structure and carcass ply and shaped according to the transverse-curvature profile of the layer formed by said coils.

While being conceived in particular with reference to the manufacture of tyres for high-performance motorcycles, the innovatory principles suggested by the present invention can be adopted to advantage in the manufacture of any type of tyre in which the belt structure is made separately from the carcass structure and subsequently assembled, and at all events in the manufacture of any composite article in which provision is made for one or more steps requiring the use of auxiliary elements in the form of an elastomeric sheet for supporting and/or structurally stabilizing other components submitted to processing.

It is known that during the manufacture of tyres for motor-vehicles, or in any event tyres characterized by a high transverse curvature, the belt structure is made on a so-called "comb drum", to be subsequently picked up, after application of the tread band, by a transfer ring bringing it into engagement with a carcass structure previously made on a building drum.

In greater detail, according to the traditional tyre manufacturing method, for making the belt structure one or more belt strips are wound in mutual overlapping relation round the comb drum so that, when winding has been completed, said belt strips are substantially shaped as a cylindrical sleeve. At this point, upon intervention of a plurality of radially expansible sectors provided in the comb drum, the belt structure acquires a curvilinear transverse profile substantially coinciding with the transverse profile that the finished tyre will have.

The thus shaped belt structure is ready to be picked up from the comb drum and be coupled with the carcass structure, after application of the tread band.

One example of the above described state of the art is given in the Italian Patent Application No. 22730A/89 in the name of the same applicant.

Recently, referring above all to high-performance tyres for motorcycles, belt structures have become increasingly more used which essentially consist of a single cord or a plurality of cords disposed parallelly in side by side relation to form a ribbon-like structure which is directly wound on the comb drum in a plurality of circumferential parallel side by side coils substantially oriented in the rolling direction of the tyre. Such a tyre is disclosed for example in the Italian Patent Application No. 20646A/90 in the name of the same applicant.

In this solution it is necessary that the winding operation be executed with the expansible sectors of the comb drum already extracted from the drum itself. In fact, since the cord used is of the inextensible type, it would be impossible to carry out the radial extraction of the sectors, if the cord had been previously wound on the comb drum in a cylindrical configuration.

However, the individual coils could encounter problems in terms of stability during winding, due to the fact that the sectors on which said cord is to be wound have a curved profile. It is therefore necessary that before the winding operation, an auxiliary support element of raw elastomeric material be laid down on the comb drum. This auxiliary element, by virtue of its adhesiveness, is capable of ensuring the geometrical and structural stability of the coil layer being progressively formed during the cord winding.

This auxiliary support element, made in the form of a sheet obtained through usual drawing and/or calendering steps, is wrapped in the form of a cylindrical sleeve round the comb drum having its sectors retracted, to be then expanded and shaped according to the radially external profile of the expansible sectors, following extraction of the latter before the beginning of the cord winding.

The fundamental properties of this support element are therefore stretchability and adhesiveness so that the element will be bound not only to the cord that is going to be wound, but also, during the tyre manufacture, to the adjacent elements.

For the purpose, the use of natural rubber possessing both a good adhesiveness and a good stretchability in a raw state is therefore preferred: the bond between said support element and the adjacent elements is further promoted by the fact that also the rubberizing blends for the carcass plies and the belt strips are mainly natural-rubber-based blends.

On the other hand, this auxiliary support element does not perform any structural function, its only aim being that of stabilizing the coils formed by the cord while the belt structure is being made, so that its presence in the finished tyre is not essential. It would be therefore desirable for the elastomeric sheet forming said support element to have weight and thickness as much as possible reduced in order to minimize the effects of its presence in the finished tyre, in particular for the purpose of restraining the centrifugal forces induced by said support element and reducing the resistance to rolling of the tyre during the running.

Furthermore, natural rubber and also other known blends, while having sufficient stretchability as a whole, do not bear a thickness reduction under 0.5 mm, due to the insufficient mechanical strength at high localized stretching variations, like those generated during the radial expansion of the curved sectors of the comb drum.

One could think about increasing this strength by means of appropriate reinforcing fillers; however known methods of imparting good mechanical-strength features to an unvulcanised elastomeric material, based on the use either of previously cross-linked or crystalline polymers, or textile or mineral fibres, did not give satisfactory results: in fact they had several disadvantages, in particular a strong adhesiveness reduction often without increasing and even decreasing stretchability.

There are also other reasons preventing the sizes of said auxiliary element from being reduced under the above mentioned value: in fact, with presently used traditional blends and with usual machines, practical problems arise that virtually do not enable sheet thicknesses lower than 0.5 mm to be achieved. The following drawbacks should be noted in particular: the material has a tendency to adhere to the machine components (the calender cylinders, for example) so that it tears on separation; the sheet thickness does not keep constant but it increases on its coming out of the machine and in addition said thickness varies in an uneven manner, transversally of the feed direction of the sheet; and it is very difficult (sometimes even impossible) to collect the sheet and convey it to the subsequent use stations without causing pleats and, as a result, strong localized variations in thickness.

In accordance with the present invention, it has been found that making the auxiliary support element of an elastomeric material filled with appropriate bonding means, preferably consisting of short fibrillose fibres of poly-para-phenylene terephthalamide (usually defined as aramid pulp) commercially known as Kevlar* Pulp or Twaron** Pulp (*registered trademark of Du Pont; ** registered trademark of Akzo) in an amount included between 1 and 10 phr, a surprising increase in the structural strength of the elastomeric sheet is achieved along with high adhesiveness and constancy in the imposed size values, so that it is possible to achieve greatly lower thicknesses as compared with those of the known art. The sheet thus produced is capable of bearing without damages the stresses it undergoes during the sheet preparation process, that is its winding and unwinding round and from the collecting rolls, its separation from the support means (usually polythene or other service material), its laying onto the comb drum and the subsequent stretching, by expansion of the curved sectors.

In a further aspect the invention relates to a tyre of high transverse curvature, in particular for motor-vehicle wheels, characterized in that said auxiliary support element comprises fibrillose short fibres homogeneously distributed in the elastomeric material so as to increase the stretchability features of said sheet without substantially altering the adhesiveness features of said elastomeric material in the raw state.

Preferentially, said fibrillose short fibres comprise short fibres of poly-para-phenylene terephthalamide, inserted in the elastomeric material forming said sheet in an amount included between 1 and 10 phr and having a length included between 0.1 mm and 2.5 mm.

Advantageously, said sheet of elastomeric material has a thickness included between 0.075 and 0.5 mm.

Preferably, said fibrillose short fibres are pre-oriented (by a calendering operation for example) in the major direction of the forces to which the support element is submitted during the tyre manufacture process. Normally this direction is the circumferential direction of the tyre and said pre-orienting operation is preferentially carried out by calendering of said sheet during the manufacture process of same.

The elastomeric material reinforced with said aramid, in the raw state has a tensile strength included between 3 and 7 MPa and a 50% elongation under a traction load included between 0.2 and 0.5 mPa.

Preferentially the material forming said auxiliary support element is a natural rubber-based blend containing carbon black in an amount included between 30 and 70 phr, filled with usual ingredients known in the art (plasticizers, protection agents, degradation-resistent and vulcanising agents) so as to obtain an elastomeric matrix as much as possible similar to that of the elements to which said sheet must adhere.

The invention also relates to a process for manufacturing said tyre, and the auxiliary support element as such, to be generally used for structural stabilization of constructional components in a composite manufactured article, in the intermediate manufacturing steps of same.

Further features and advantages will become more apparent from the detailed description of a preferred embodiment of a high-transverse-curvature tyre in particular for motor-vehicles, in accordance with the present invention. This description will be given hereinafter, by way of non-limiting example, with reference to the accompanying drawings, in which:

- Fig. 1 is a cross-sectional profile of a tyre made in accordance with the present invention;
- Figs. 2 to 6 diagrammatically show some steps of the manufacturing process of the tyre of the invention.

Referring to the drawings, a high-transverse-curvature tyre in particular for motor-vehicles in accordance with the present invention has been generally identified by reference numeral 1.

Tyre 1 has a carcass structure 2 comprising at least one carcass ply 3 the opposite side edges 3a of which are turned back around corresponding bead cores 4.

An elastomeric filler is applied to the external perimetric edge of the bead cores 4 and it occupies the space defined between the carcass ply 3 and the corresponding turned back side edge 3a.

Associated with the carcass structure 2 is a belt structure 6 essentially consisting of at least one inextensible cord 7 extending in a crown configuration circumferentially of the carcass ply 3 to form a plurality of parallel coils 7a disposed consecutively in side by side relation and substantially oriented in the rolling direction of the tyre 1.

The coils 7a disposed consecutively side by side to form a curvilinear profile, by virtue of their longitudinal inextensibility cause a structural and dimensional stabilization of the tyre 1 according to the desired transverse-curvature profile.

In known manner, a tread band 8 is applied to the belt structure 6, said tread being the ground-contacting area of the tyre.

As shown in Fig. 1, coils 7a formed of the inextensible cord 7 are wound on an auxiliary support element 9 substantially consisting of an elastomeric sheet interposed between the belt structure 6 and carcass ply 3 and shaped like the transverse-curvature profile of the layer formed by the coils themselves.

Referring particularly to Figs. 2 to 6 diagrammatically showing some of the main manufacturing steps of the tyre, laying of the auxiliary support element 9 onto an usual comb drum 10 is first carried out, as shown in Fig. 2, so as to make the belt structure and give it a cylindrical conformation.

Subsequently, as shown in Fig. 3, the extraction of a plurality of radially expansible curved sectors 11 usually associated with the comb drum 10 is caused, the shape of said sectors conforming to the intended cross-sectional profile of the belt structure 6. Under this situation, the auxiliary support element 9 is forced to expand and undergoes a plastic stretching so that it takes the shape of the external profile of the expansible sectors 11. Then winding of the inextensible cord 7 in a plurality of coils 7a disposed consecutively side by side is carried out, starting from one of the end edges of the auxiliary support element 9 for example, as shown in Fig. 3. During this step, the adhesiveness of the raw elastomeric material forming the auxiliary support element ensures a stable positioning of the individual coils 7a formed on the expansible sectors 11, without any risk that the coils will undesirably slip along the external profile of said sectors.

When winding is over, with the optional aid of presser rollers 12 (Fig. 4), the application of the tread band 8 to the belt structure 6 formed on the expansible sectors 11 of the comb drum 10 is carried out.

In known manner the belt structure 6, together with the tread band 8 to which said belt is applied, is taken up by a transfer ring 13 provided with appropriate grasping means 14 and is coaxially fitted onto the carcass structure 2 previously formed on a building drum 15 associated with said manufacturing machine. The carcass ply first arranged in the form of a cylindrical sleeve is radially expanded by axially moving the bead cores 4 close to each other upon command of the building drum 15 and optionally admitting air to the inside of said sleeve, in order to obtain fitting of same to the radially inner surface of the belt structure 6, and more particularly, the auxiliary support element 9.

The manufactured tyre 1 will be then taken up from the building drum 15 to be submitted to the final vulcanization process.

In the light of the above, it will be recognized that the auxiliary support element 9 quite conveniently retains the coils 7a formed by the cord 7 to give the belt 6 a sufficient structural stability while it is being made and in the subsequent handling steps preceding mounting of same to the carcass structure 2. Further advantages to the operating features of the vulcanised tyre appear to having be obtained with the presence of the auxiliary element 9, even if, at the moment, they are not completely cleared up. Anyway, the auxiliary support element 9 should be made as thin as possible in order to conveniently restrain its bulkiness and weight, taking into account the fact that the weight of said support element is of great importance in connection with the generation of centrifugal forces since it is located in the tyre areas of maximum radius.

In accordance with the present invention, in order to enable the manufacture and use of auxiliary support elements 9 of much lower thickness than thicknesses permitted in the known art, it has been envisaged that the elastomeric material forming the auxiliary element should contain the so-called aramid pulp (fibrillose short fibres of poly-para-phenylene terephthalamide) homogeneously dispersed therein, of the type commercially known as "Kevlar-pulp" or "Twaron-pulp" (Kevlar and Twaron are registered trademarks of Du Pont and Akzo, respectively) or equivalent bonding means, adapted to increase the mechanical strength and stretchability features of the elastomeric material in the raw state, without substantially altering the adhesiveness features of same.

It has been found in fact that in the presence of aramid fibres dispersed in the elastomeric material blend forming said auxiliary support element 9, the latter can be made in the form of a very thin sheet, without undergoing any tearing as a result of the plastic deformations induced therein by effect of the extraction of the expansible sectors 11 from the comb drum, and upon the action of the tangential stresses transmitted during laying of the inextensible cord 7.

In greater detail, it has been found that the best results are achieved by introducing the aramid pulp into the raw elastomer blend in an amount included between 1 and 10 phr (parts by weight per 100 parts of rubber) and using fibres of a length included between 0.1 and 2.5 mm.

Practically, by adopting the innovatory solutions proposed by the invention, it is possible to make and use in the tyre manufacture, an auxiliary support element 9 of a thickness included between 0.075 and 0.5 mm, preferably in the range of 0.25 mm or less, so that its weight is less than halved as compared with the weight of the auxiliary elements made according to the known art.

The resistance to the stretching actions induced by extraction of the expansible sectors 11 can be further increased if the auxiliary element 9 is made by calendering, so that the aramid fibres are pre-oriented in a preferential direction in the elastomer sheet forming the auxiliary element itself: this preferential direction usually is (at least for use in the described tyre) the circumferential direction of the tyre coinciding with the longitudinal direction of the sheet emerging from the calender.

By way of example, in the following table the compositions of six different blends are reproduced, namely a traditional blend (A) for the specified use, two blends (B, C) reinforced according to the solutions of the known art and three blends (D, E, F) according to the invention.

In particular, blend B was reinforced by means of a crystalline polymer named transpolyoctenamer, best known as "Vestenamer 8612" available from HÜLS, whereas blend C was reinforced by means of a previously cross-linked polymer, commercially known as SBR4503 available from AMERIPOL SYNPOL Corp.

For all cited blends, tensile strength (in MPa) and adhesiveness (evaluated according to a scale from 0 to 10) are shown, these values being measured on the unvulcanised blend.

It is possible to see that in the blends according to the invention, due to the addition of aramid fibres with a distribution of lengths between 0.2 and 0.8 mm in an amount included between 1 and 5 phr, a tensile strength varying between 3 and 5 MPa was obtained, with a 50% elongation under traction loads included between 0.6 and 2.5 MPa respectively, while maintaining the adhesiveness value of the traditional blend substantially unaltered.

In the same elastomer, devoid of aramid fibres, the tensile strength corresponds to 1.6 MPa, whereas an elongation of 50% is caused by a traction load of 0.3 MPa.

On the contrary, in blends reinforced in the usual manner the tensile strength values are comparable with those of the blends of the invention, but the adhesiveness value shows completely inacceptable values, that is of the order of 50%.

TABLE

INGREDIENTS/BLENDS	A	B	C	D	E	F
Natural rubber	100	70	70	100	100	100
Carbon black	55	55	55	55	55	55
Vestenamer 8612	=	30	=	=	=	=
SBR 4503	=	=	30	=	=	=
Aramid pulp	=	=	=	1	3.5	5
Zinc oxide	5	5	5	5	5	5
Protective system	2	2	2	2	2	2
Vulcanizing system	5	5	5	5	5	5
PROPERTIES/BLENDS	A	B	C	D	E	F
50% Elongation modulus	0.3	1.5	1	0.6	1.5	2.5
Tensile strength	1.6	5.5	4.8	3	4.5	5
Adhesivity	9	4	5	9	8	8

Obviously the stated values can be varied within some limits depending on the type of elastomer and blend used, and also depending on the amount and typology of the aramid fibres used.

For the purposes of the present invention, it is however preferable that the tensile strength be included between 3 and 7 mPa and that a 50% elongation should be caused by a load included between 0.6 and 3 MPa.

It is pointed out that the innovatory principles proposed by the present invention can be adopted to advantage for making any type of auxiliary reinforcing element to be used for purposes different from the described one. In greater detail, said innovatory principles can be conveniently employed in all cases in which a so-called "service semi-finished product" is to be introduced into the structure of a manufactured article of elastomeric material, which semi-finished product does not directly affect the operating behaviour of the finished product but only performs support functions in the manunfacturing process of the finished product. For example, the introduction of bonding means such as aramid fibres can be adopted in making "junction-covering straps", that is straps used to joint two portions of rubberized cloth end to end in order to prevent opening of the junction when the semi-finished product is being handled during the manufacturing steps.

It is apparent that the possibility of reducing the thickness of these service semi-finished products is very advantageous because the presence of these elements in the finished product is not of practical utility but, on the contrary, is a source of structural unevenness the importance of which increases with the increasing of the thickness of said semi-finished product.

The present invention is believed to produce its beneficial effects with all the types of inextensible cords (textile such as those of aramid or metallic such as those of the regular lay type) usually adopted for the construction of the belt structure in the tyres for vehicle wheels. Particularly the present invention showed to produce results of specific relevance when adopted in tyres for two-wheeled vehicles. More specifically, the present invention showed very good results (as shown by a series of road tests made by the Applicant) when adopted in combination with the very well known High Elongation type metallic cords described in more details in the above cited Italian patent application. No.20646A/90, to which one may refer for further exhaustive information, both in respect of the cord itself and of the tyre structure.

Said cords have a typical behavior under load, characterized by a load-elongation diagram having a curvilinear portion (whose center line usually ranges between an elongation value of 1.5% to 3%) which mutually connects two substantially rectilinear lengths of different slope relative to the axes of said diagram, such that the cord is initially more elongated at low loads.

The above cited results denote that the auxiliary element 9 according to the invention has also a great influence on the operating characteristics of the tyre in exercise, particularly as far as regards the entity of the slip thrust supported by the tyre under drift, with consequent not negligible increase of its performance level, mainly in terms of speed and stability at high speed.

Once the skilled in the art understands the invention, as described hereabove, he will be able to make those selections, variations and modifications to the variables which are associated with the invention to meet his specific technical needs.

Claims

1. A high-transverse-curvature tyre, in particular for motor-vehicle wheels, comprising:

   - a carcass structure (2) consisting of at least one carcass ply (3) having its circumferential end edges (3a) turned back around two bead cores (4);
   - a belt structure (6) extending circumferentially about the carcass ply (3) and having at least one circumferentially inextensible cord (7) wound in a plurality of circumferential coils (7a) disposed side by side according to a curvilinear transverse profile;
   - a tread band (8) applied circumferentially to the belt structure (6);

   said inextensible cord (7) being wound on an auxiliary support element (9) of elastomeric material, made in the form of a sheet interposed between the belt structure (2) and carcass ply (3) and shaped according to the transverse-curvature profile of the layer formed by said coils (7a),
   characterized in that said auxiliary support element (9) further comprises bonding means homogeneously distributed in the elastomeric material forming said sheet for increasing the stretchability features of said material without substantially altering the adhesiveness features of same during the tyre manufacturing steps, when said material is in the raw state.

2. A tyre according to claim 1, characterized in that said bonding means comprises aramid pulp.

3. A tyre according to claim 2, characterized in that said aramid pulp is introduced into the elastomeric material forming said sheet in an amount included between 1 and 10 phr.

4. A tyre according to claim 2, characterized in that said aramid pulp comprises fibrillose short fibres of poly-paraphenylene terephthalamide having a length included between 0.1 and 2.5 mm.

5. A tyre according to claim 1, characterized in that said sheet of elastomeric material has a thickness included between 0.075 and 0.5 mm.

6. A tyre according to claim 2, characterized in that said aramid fibres are pre-oriented in a preferential direction following a calendering operation carried out on said sheet while the latter is being manufactured.

7. A tyre according to claim 2, characterized in that the elastomeric material reinforced with said aramid fibres, in the raw state has a tensile strength included between 3 and 7 MPa with a 50% elongation caused by a traction load included between 0.6 and 3 mPa.

8. An auxiliary support element for the structural stabilization of constructional components in a composite manufactured article during the intermediate steps for the manufacture of same, said auxiliary support element (9) being made in the form of a thin sheet of raw elastomeric material to be cross-linked following a vulcanization step provided in the manufacturing process of the finished article, and being characterized in that it further comprises bonding means homogeneously distributed in the raw elastomeric material to increase the stretchability features of said material without substantially altering the adhesiveness features of same.

9. An auxiliary support element according to claim 8, characterized in that said bonding means comprises aramid pulp.

10. An auxiliary support element according to claim 9, characterized in that said aramid pulp is provided in an amount included between 1 and 10 phr.

11. An auxiliary support element according to claim 10, characterized in that the aramid fibres in said pulp have a length included between 0.1 and 2.5 mm.

12. An auxiliary support element according to claim 11, characterized in that said sheet of elastomeric material has a thickness included between 0.075 and 0.5 mm.

13. An auxiliary support element according to claim 9, characterized in that said aramid fibres are pre-oriented in a preferential direction following a calendering operation carried out on said auxiliary support element while the latter is being manufactured.

14. An auxiliary support element according to claim 9, characterized in that the elastomeric material reinforced with said aramid fibres, in the raw state has a tensile strength included between 3 and 7 MPa with a 50% elongation under a traction load included between 0.6 and 3 mPa.

15. A process for the manufacture of a high-transverse-curvature tyre, in particular for motor-vehicle wheels, comprising the steps of:

- previously manufacturing a carcass structure (2) comprising at least one carcass ply (3) having its edges (3a) turned back around two bead cores (4);
- arranging an auxiliary support element (9) on a comb drum (10), which support element is made in the form of an elastomer sheet wound round the drum itself;
- shaping the auxiliary support element (9) so as to give it a curvilinear transverse profile, through radial expansion of a plurality of radially movable sectors (11) associated with the comb drum (10);
- circumferentially winding round the auxiliary support element (9), at least one inextensible cord (7) forming a plurality of circumferential coils (7a) disposed consecutively side by side to define a belt structure (6) of a curvilinear transverse profile;
- circumferentially applying a tread band (8) to the belt structure (6);
- applying the belt structure (6) together with the tread band (8) to the circumference of the previously manufactured carcass structure (2),

characterized in that in the elastomeric material intended to form the auxiliary support element (9), blending of bonding means is previously provided, in order to increase the stretchability features of said material without substantially altering the adhesiveness features of same.

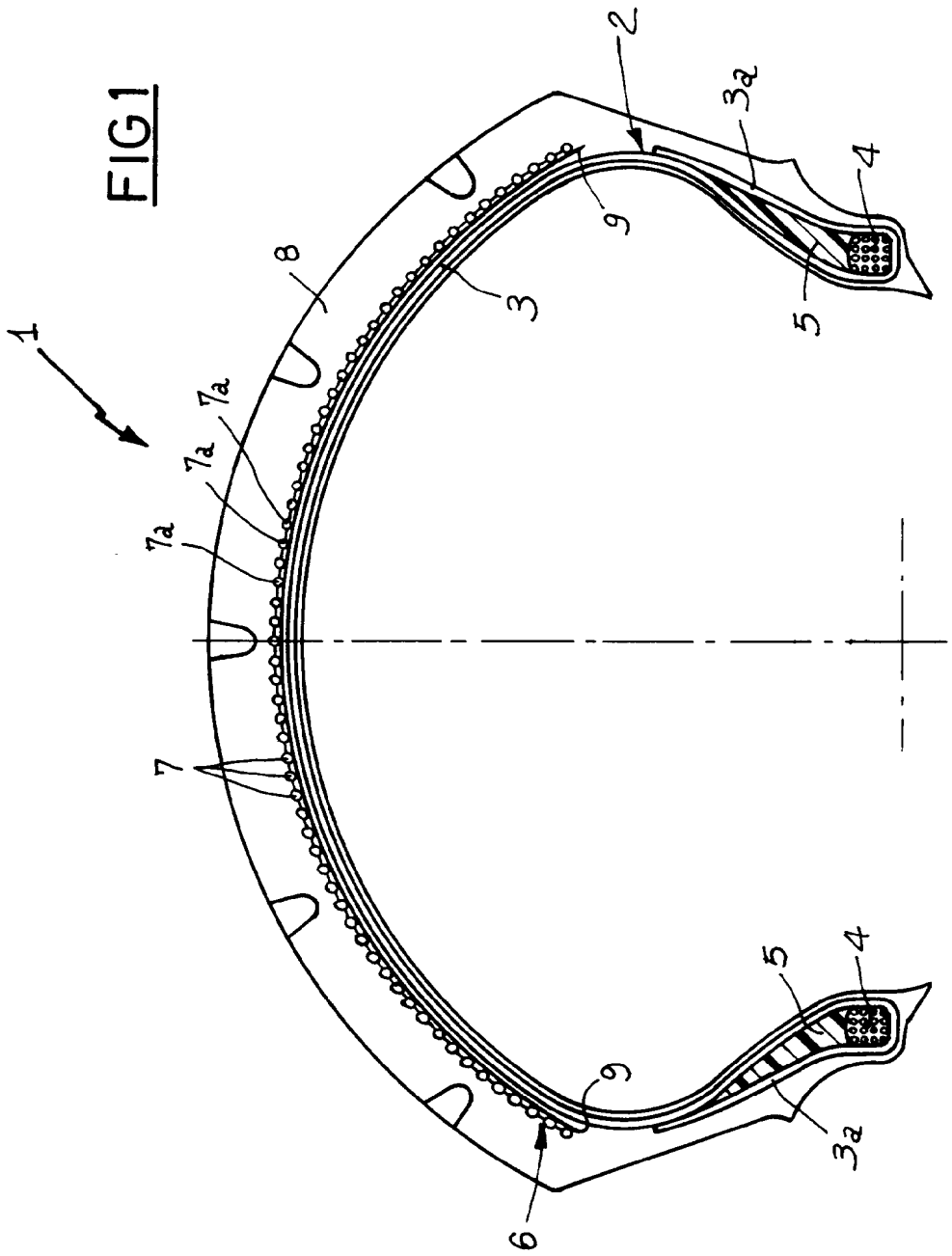
16. A process according to claim 15, characterized in that said bonding means comprise aramid pulp.

17. A process according to claim 16, characterized in that said aramid pulp is introduced into the elastomeric material in an amount included between 1 and 10 phr.

18. A process according to claim 17, characterized in that the fibres in said aramid pulp have a length included between 0.1 and 2.5 nn.

19. A process according to claim 15, characterized in that the auxiliary support element (9) is formed through a calendering step, for pre-orienting said aramid fibres in a preferential direction in the elastomeric material.

FIG1



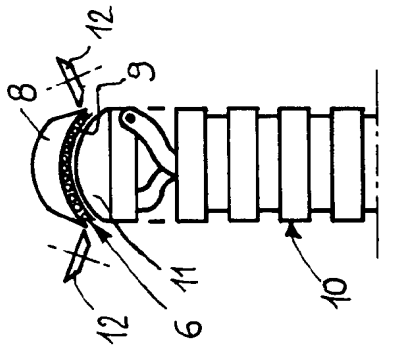


FIG 4

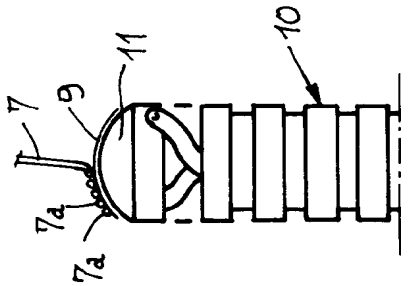


FIG 3

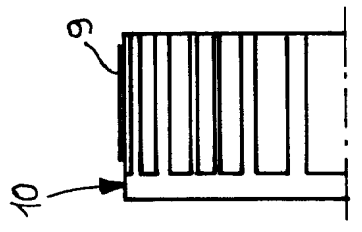


FIG 2

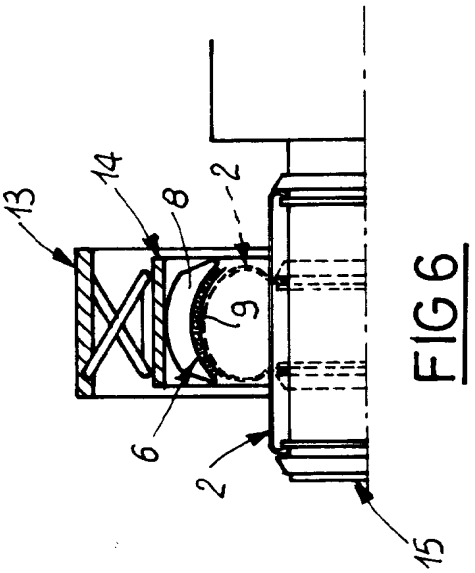


FIG 6

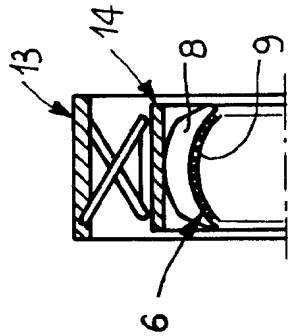


FIG 5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 9953

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	EP-A-0 329 589 (THE GOODYEAR TIRE&RUBBER CO.) * page 8, line 57 - page 9, line 11; claims; figures *	8-11,13, 14	B60C9/18 B60C9/22
Y		1-7, 15-19	
Y,D D	EP-A-0 461 646 (PIRELLI S.P.A.) * claims; figures * & IT-A-1 248 851 (...)	1-7	
Y,D D	EP-A-0 433 974 (PIRELLI S.P.A.) * claims; figures * & IT-A-2 273 089 (...)	15-19	
A	EP-A-0 320 705 (PIRELLI S.P.A.) * claims; figures *	1,8	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B60C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 March 1996	Baradat, J-L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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